

# BRUSHLESS DC MOTORS



BLDC Gearmotor Size 9



BLDC 22mm



BLDC Gearmotor Size 5



nuvoDisc 32BF

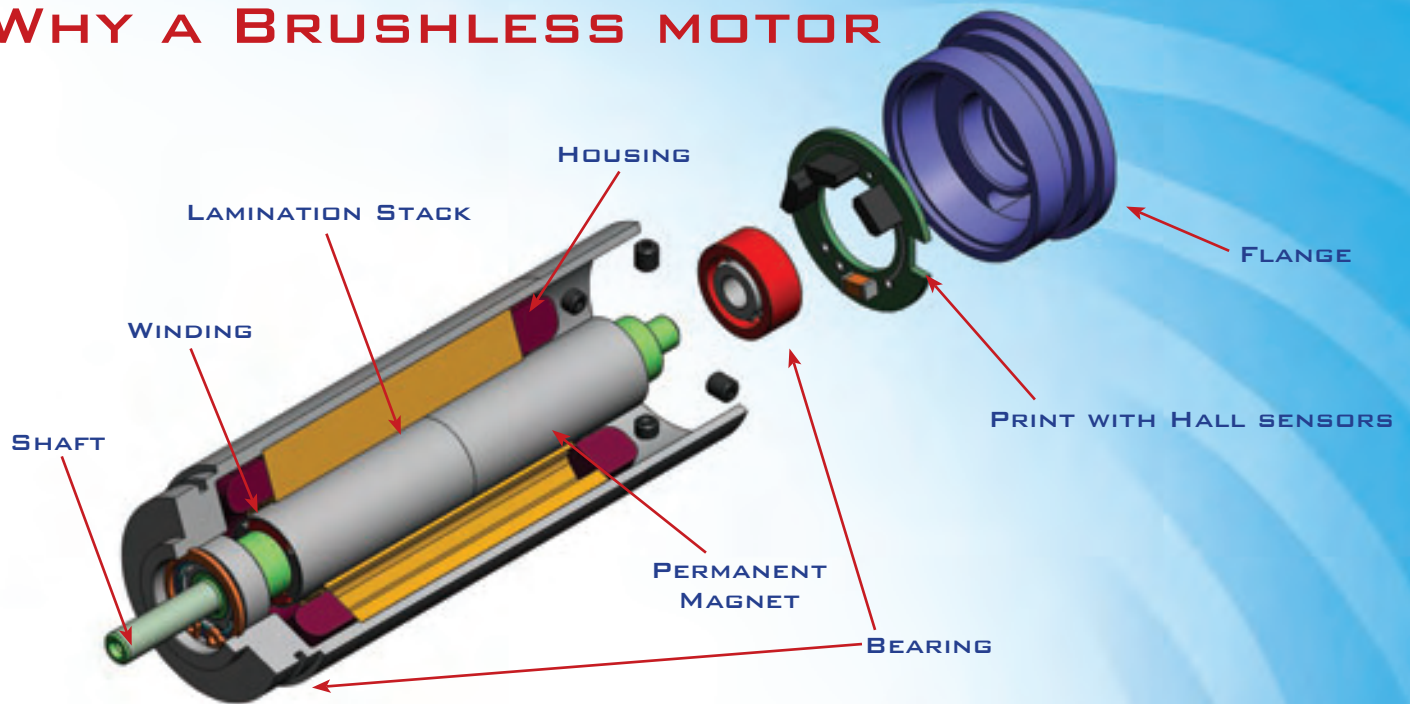
## Portescap

Portescap Brushless DC motors are extremely reliable and built to deliver the best performances. Their high power density allows a reduction in the overall size of most of the applications. They feature silent running even at high speed. The autoclavable option is ideal for medical applications.

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# WHY A BRUSHLESS MOTOR



## BRUSHLESS TECHNOLOGY

Conventional DC motors use a stationary magnet with a rotating armature combining the commutation segments and brushes to provide automatic commutation. In comparison, the brushless DC motor is a reversed design: the permanent magnet is rotating whereas the windings are part of the stator and can be energized without requiring a commutator-and-brush system. Therefore this motor type achieves very long, trouble-free life even while operating at very high speeds.

## SLOTTED & SLOTLESS TECHNOLOGIES

One technology uses a stator that consists of stacked steel lamination with winding placed in the slots that are axially cut along the inner periphery.

This is called the *BLDC motor, slotted iron structure*.

The other technology uses a self-supporting cylindrical ironless coil made in the same winding technique as for our ironless rotor DC motors.

This is called the *BLDC motor, slotless iron structure*.

## STANDARD FEATURES

- Max Continuous stall torque up to 39 oz-in (276 mNm)
- Peak torque up to 332.7 oz-in (2'278 mNm)
- Speed up to 100'000rpm
- Standard diameter from 0.5 to 2.3 in (12.7 to 58 mm)

### • No mechanical commutation

Long life (limited only by wear on ball bearings)

### • Mainly linear motor characteristic

Excellent speed and position control

### • Static winding attached to motor housing

Improved heat dissipation and overload capability

### • High efficiency

### • Autoclavable Option Available

## YOUR CUSTOM MOTOR

### • Various stack lengths available in each frame size

### • Autoclavable option

### • Custom winding

### • Shaft modification including hollow shaft

### • Special material, coating and plating

### • Lead length, type, color and connector

### • Gearhead

### • Encoder

# HOW TO SELECT YOUR BRUSHLESS MOTOR

## HALL SENSORS

In general, BLDC motors have three phase windings. The easiest way is to power two of them at a time, using Hall sensors to know the rotor position. A simple logic allows for optimal energizing of the phases as a function of rotor position, just like the commutator and brushes are doing in the conventional DC motor.

**Possible applications:** high variation of speed and/or load, positioning

## SENSORLESS

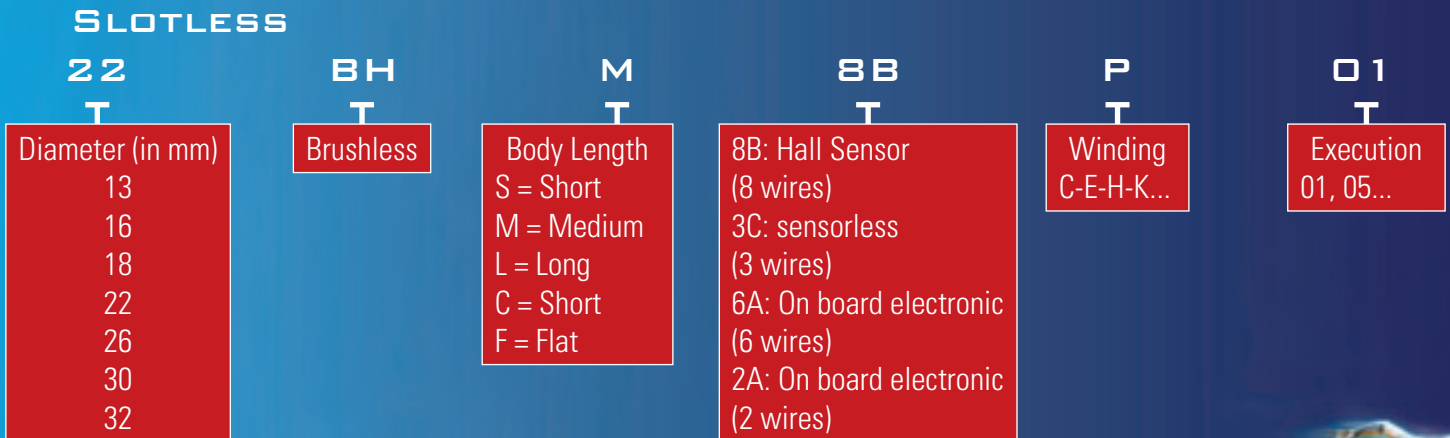
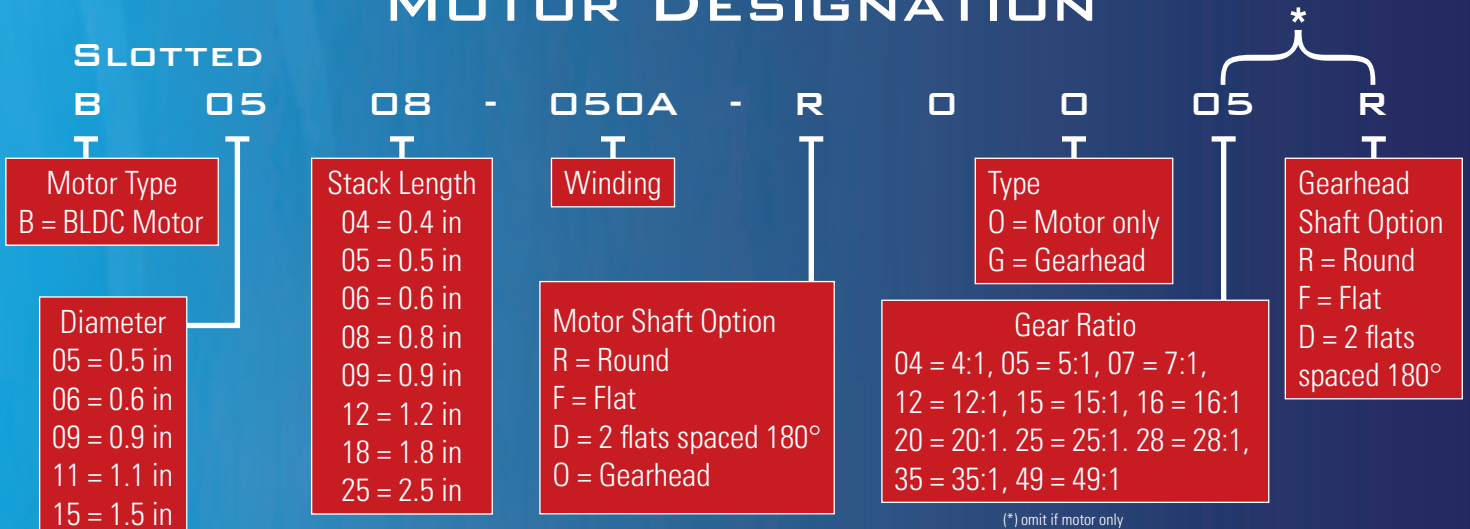
With this solution the motor includes no sensors or electronic components and it is therefore highly insensitive to hostile environments.

In all motors, the relation of back-EMF and torque versus rotor position is the same. Zero crossing of the voltage induced in the non-energized winding corresponds to the position of maximum torque generated by the two energized phases. This point of zero crossing therefore allows to determine the moment when the following commutation should take place depending on motor speed. This time interval is in fact equivalent to the time the motor takes to move from the position of the preceding commutation to the back-EMF zero crossing position.

Electronic circuits designed for this commutation function allow for easy operation of sensorless motors. As the back-EMF information is necessary to know the rotor position, sensorless commutation doesn't work with the motor at stall or extremely low speed.

**For applications:** constant speed and load (spindle), cable diameter limitation

## MOTOR DESIGNATION



# EXPLANATION OF SPECIFICATIONS

MOTOR PART SPECIFICATION	EXPLANATION
BACK-EMF CONSTANT $K_b$ [V/krpm] +/-8%	Voltage induced at a motor speed of 1'000 rpm
ELECTRICAL TIME CONSTANT $t_e$ [ms]	The time required for current to reach 63% of its final value for a fixed voltage level
INDUCTANCE L [mH]	Measured with a frequency of 1 kHz between 2 phases of the stalled motor. The value gives an order of magnitude
MAX CONTINUOUS POWER AT 10krpm [W]	Power developed at 10krpm so the motor doesn't exceed its thermal rating
MAX CONTINUOUS POWER DISSIPATION [W]	The maximum power the motor can dissipate without exceeding its thermal rating
MAX CONTINUOUS STALL CURRENT OR MAX CONTINUOUS CURRENT $I_{cs}$ [A]	Current drawn by the motor at zero speed (locked condition) so the motor doesn't exceed its thermal rating.
MAX CONTINUOUS STALL TORQUE $T_{cs}$ [mNm OR oz-in]	The amount of torque at zero speed, which a motor can continuously deliver without exceeding its thermal rating
MAX CONTINUOUS TORQUE AT 10krpm [mNm OR oz-in]	Torque developed at 10krpm so the motor temperature doesn't exceed its thermal rating
MOTOR CONSTANT 10krpm [mNm/watt <sup>1/2</sup> OR oz-in/watt <sup>1/2</sup> ]	Figure of merit to evaluate motor
NO-LOAD CURRENT $I_0$ [mA] +/-50%	Current of the unloaded motor at no-load speed. It represents the friction losses of the standard motor at that speed.
NO-LOAD SPEED $\omega_n$ or $n_0$ [rpm] +/-10%	Speed of the unloaded motor, it is proportional to the supply voltage.
MEASURING OR RATED VOLTAGE U OR $V_f$ [V]	Supply voltage at which the characteristics have been measured (at 20/25°C).
MECHANICAL TIME CONSTANT $t_m$ [ms]	It is the product of motor regulation ( $R/k^2$ ) and rotor inertia J. It describes the motor physically taking into account electrical (R), magnetic ( $K_b$ ) and mechanical ( $J_m$ ) parameters. It is the time needed by the motor to reach 63% of its no-load speed or of its final speed in view of the voltage and load conditions.
PEAK CURRENT $I_{pk}$ [A]	The current drawn by the motor when delivering peak torque
PEAK TORQUE [mNm OR oz-in]	The maximum torque a brushless motor can deliver for short periods of time.
RESISTANCE R [Ohm] +/-10%	Terminal resistance phase to phase at 25°C
ROTOR INERTIA $J_m$ [kg-m <sup>2</sup> or oz-in-sec <sup>2</sup> ]	Rotor (magnet and shaft) inertia
STATIC FRICTION TORQUE $T_f$ [mNm OR oz-in]	Torque required to turn the motor shaft with out powering the motor
THERMAL RESISTANCE [°C/Watt]	Gives the motor temperature rise for a power dissipation of 1 W. For slotted motor the value is measured with motor mounted on a 6.0" x 6.0" x 0.25" aluminum heat sink For slotless motor the value is measured under unfavorable conditions (motor alone). With measuring methods reflecting more common operating conditions, values which are 10 to 50% lower may be obtained.
TORQUE CONSTANT $K_t$ [mNm/A OR oz-in/A] +/-10%	Indicates the torque developed for a current of 1 Amp
VISCOUS TORQUE (LOSSES) [mNm/krpm OR oz-in/krpm]	Inherent losses such as friction in the ball bearings and Foucault current. Those are proportional to speed.
WEIGHT W [g OR oz]	Average weight of the standard motor

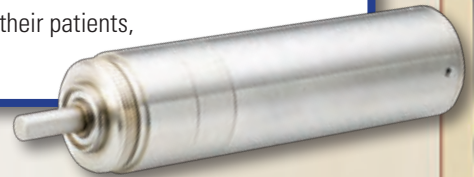
# WHERE TO APPLY YOUR PORTESCAP BRUSHLESS MOTOR



## SURGICAL HAND TOOL

When you're an orthopedic surgeon performing multiple operations in a day, hand tools that are powerful and precise are a must. However, a smaller, more lightweight version of the tool would be a welcome relief. Portescap supplies customized solutions that are exceptionally lightweight but do not compromise performance. Its lightweight feel and low-heat feature reduce hand fatigue in surgeons.

Suitable sealing and optimized design assure adequate autoclaving and prevent contamination. So surgeons, and their patients, have a lot to feel comfortable about.



## MEDICAL

- High speed surgical hand tools
- Small bone surgical hand tools
- Large bone surgical hand tools
- Dental hand tools
- Respirators & ventilators
- Infusion & insulin pumps
- Dental imaging
- Analyzers



## INDUSTRIAL AUTOMATION

- Industrial nut runners
- Industrial screwdrivers
- Air pumps
- Conveyors
- Electronic assembly



## AEROSPACE & DEFENSE

- Aircraft on board instrumentation
- Gyroscope
- Satellites
- Valves
- Fuel metering system
- Electric actuator



## SECURITY & ACCESS

- Barcode readers
- Camera
- Locks
- Ticket printer & dispenser



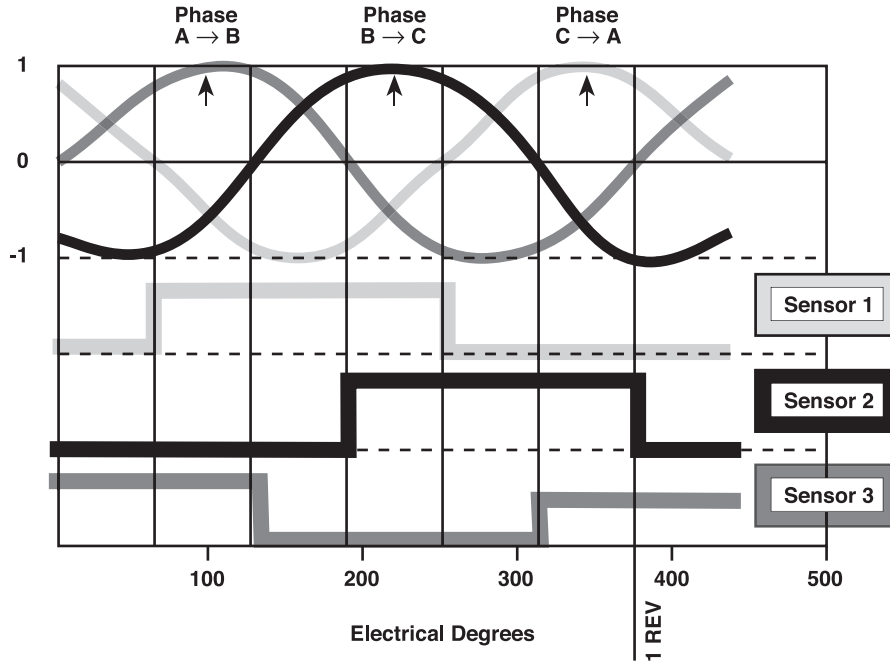
## OTHER

- Robotic
- Precision instrumentation
- Engraving

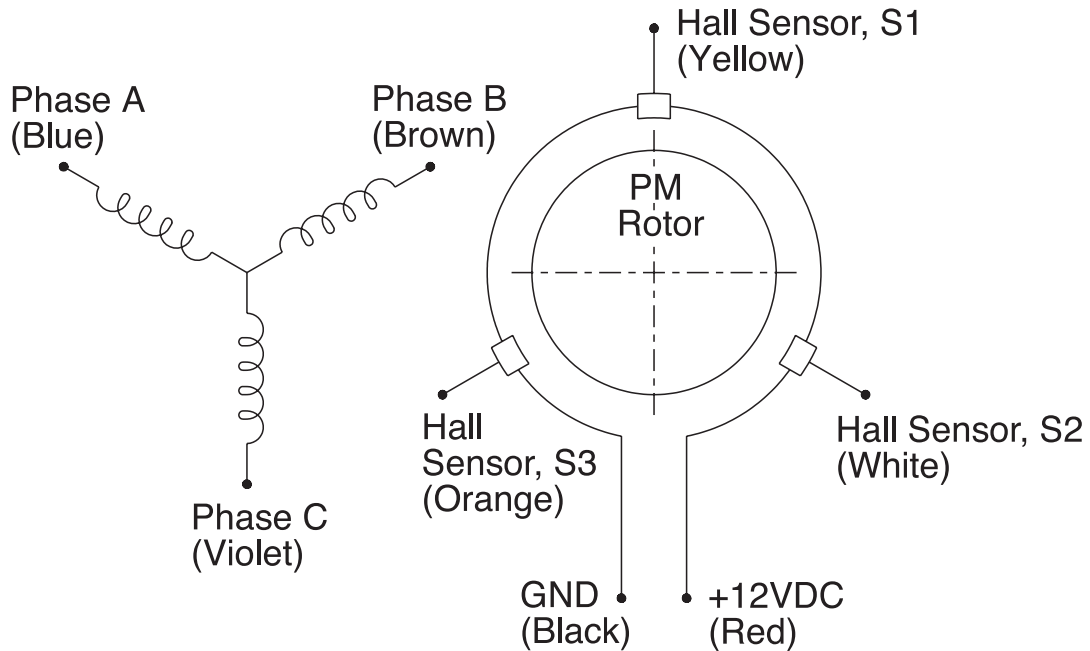


## Timing Relationship

B0504, B0508, B0512, 13BC, 16BHS, 16BHL, 22BHS, 22BHM, 22BHL

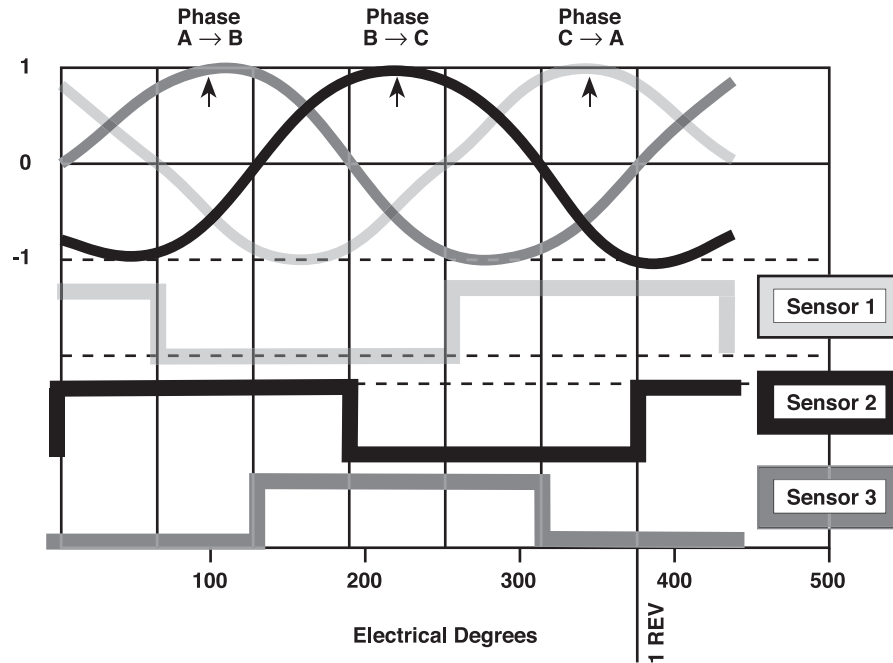


Timing relationships between the motor phases and the hall sensors that support commutation (four pole motor). CW rotation from shaft end.

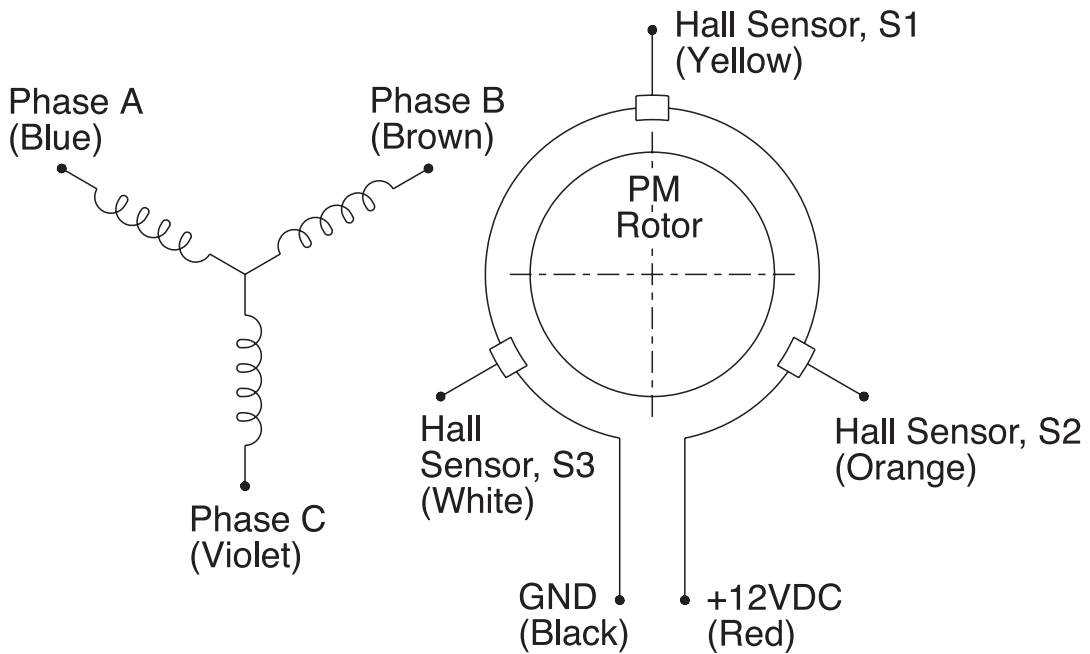


Motor is supplied with connector AMP #640430-8 which may be removed.

B0610, B0614, B906, B909, B912, B1106, B1112, B1118, B1505, B1515, B1525, nuvoDisc series



Timing relationships between the motor phases and the hall sensors that support commutation (four pole motor). CW rotation from shaft end.



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